

# Determination of Moisture, Volatile Matter, and Ash in Biomass/Plant Tissue

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## Instrument: TGA701



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### Introduction

Moisture, volatile matter, and ash are important constituents for the quality characterization of fuel materials. Moisture, as determined by this instrument, is used for calculating analytical results of the fuel to a dry basis. The ash determination is typically used to calculate ash yields for the fuel and other calculations involving the material balance for ash handling and disposal requirements for the fuel utilization. Volatile matter is a primary constituent of solid fuels used in assessing the combustion characteristics.

### Sample Preparation

Samples must be of uniform consistency to produce suitable results. Typically, samples should be ground to a fineness of <0.5 mm.

### Accessories

621-331 Ceramic Crucibles, 529-048 Ceramic Covers, 611-844 Spoon

**Sample Mass** ~1.0 g

**Analysis Time** ~4.5 hours

### Method General Parameters

Crucible Type	Ceramic
Crucible Density	3.00
Cover Density	3.00
Sample Type	Biomass
Sample Density	1.50

### System

Significant Digits	F6
Barometric Pressure	760
Cover Open Half	800
Cover Open Full	450
Furnace Over Temp.	1200
Increment Sample Names	Disable
Crucible Locations	Auto Find
Temperature Check	False
Alarm On Errors	True
Cover Option	Half Open
Carousel Option	Weigh Position
Batch Mode	False
Enable Lid Dispenser	False

### Balance

Readability	4
Balance Environment	Stable
Balance Constancy	Absolute Weight (g)
Minimum Weight	0.8 g
Maximum Weight	1.2 g
Zero Deviation	0.0005
Retake Initial Weights	False

### Method Step Parameters

Parameter	Moisture	Volatile	Ash
Covers	No	Yes	No
Start Temp. °C	25	107	600
End Temp. °C	107	950	750
Ramp Rate	6	50	3
Ramp Time (h:m)	0:13	0:16	0:50
Hold Time (h:m)	0:15	0:07	0:00
Total Time (h:m)	0:28	0:23	0:50
Max Time (h:m)	0:00	0:00	0:00
Atmosphere	Nitrogen	Nitrogen	Oxygen
Flow Rate	High	High	Low
Window	3	0	3
Comparator	0.0005 g*	100.0000 g	0.0005 g*
Final Weight	At Constancy	At End of Step	At Constancy

\*Balance constancy set for Absolute Weight (grams)

### Method Equation Parameters

Moisture	$\frac{([Initial\ Mass] - [Moisture\ Mass])}{[Initial\ Mass]} * 100$
Volatile	$\frac{([Moisture\ Mass] - [Volatile\ Mass])}{[Initial\ Mass]} * 100$
Ash	$\frac{[Ash\ Mass]}{[Initial\ Mass]} * 100$
Volatile Dry	$[Volatile] * (100 / (100 - [Moisture]))$
Ash Dry	$[Ash] * (100 / (100 - [Moisture]))$

### Procedure

1. Create and/or select a method using the parameters described above following the procedure in the TGA701 Instruction Manual.
2. Login and load samples following the procedure outlined in the TGA701 Instruction Manual.

## Typical Results

Sample	Mass(g)	% Moisture	% Volatile Matter Dry	% Ash Dry
Biomass	1.0093	5.44	83.4	0.48
Wood Pulp #1	1.0115	5.38	83.5	0.47
	1.0081	5.39	83.3	0.46
	1.0197	5.39	83.1	0.49
	1.0108	5.37	83.4	0.48
	<b>Avg. =</b>	<b>5.39</b>	<b>83.3</b>	<b>0.47</b>
	<b>s =</b>	<b>0.03</b>	<b>0.14</b>	<b>0.01</b>
Biomass	1.0308	3.32	83.3	0.34
Wood Pulp #2	1.0151	3.35	83.5	0.35
	1.0366	3.31	82.8	0.36
	1.0389	3.32	83.2	0.34
	1.0475	3.32	83.5	0.38
	<b>Avg. =</b>	<b>3.32</b>	<b>83.3</b>	<b>0.36</b>
	<b>s =</b>	<b>0.01</b>	<b>0.28</b>	<b>0.02</b>
Plant Tissue	1.0072	6.04	76.5	8.69
Alfalfa	1.0371	6.13	76.7	8.75
	1.0170	6.04	76.9	8.63
	1.0368	6.06	76.8	8.72
	1.0027	6.21	76.5	8.77
	<b>Avg. =</b>	<b>6.09</b>	<b>76.7</b>	<b>8.71</b>
	<b>s =</b>	<b>0.07</b>	<b>0.16</b>	<b>0.05</b>
Plant Tissue	1.0052	9.17	79.3	2.13
Barley	1.0104	9.22	79.2	2.28
	1.0051	9.12	79.3	2.27
	1.0028	9.14	79.9	2.25
	1.0057	9.17	79.2	2.59
	<b>Avg. =</b>	<b>9.17</b>	<b>79.4</b>	<b>2.30</b>
	<b>s =</b>	<b>0.04</b>	<b>0.31</b>	<b>0.17</b>

Note: LECO recommends a calibration of  $y=1x+0$  to be used for volatile matter determination in biomass.

